

**CANADIAN AERO MANUFACTURING  
INSTRUCTIONS FOR CONTINUING AIRWORTHINESS  
PULL START CLUTCH, Part Numbers 1971890-N, M, R and 1940969-N**  
CI-02-01 Revision: E Issue date: April 30 2003 Print date: 30/04/03 Page 1 of 5

**This ICA is Transport Canada Accepted**

**RECORD OF REVISIONS**

Revision	Effective date for new revision	Date of withdrawal of previous revision	Person making revision	Organization
E	April 30, 2003	N/A	Ron Newburg	CAM
D	May 17, 2001	N/A	Jim Watson	CAM
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**TABLE OF CONTENTS**

Section	Subject	Page
	<b>Title Page</b>	<b>1</b>
<b>1</b>	<b>Introduction</b>	<b>2</b>
<b>2</b>	<b>Eligibility</b>	<b>2</b>
<b>3</b>	<b>Pre-installation Inspection</b>	<b>2-3</b>
<b>4</b>	<b>Installation</b>	<b>3</b>
<b>5</b>	<b>Continuous Airworthiness</b>	<b>3-4</b>
<b>6</b>	<b>Additional Maintenance Requirements</b>	<b>4-5</b>
<b>7</b>	<b>Trouble shooting</b>	<b>5</b>

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CI-02-01 Revision: E Issue date: April 30 2003 Print date: 30/04/03 Page 2 of 5

## 1. INTRODUCTION:

1.1 All CAM Pull Clutches are manufactured as per Canadian Aero Manufacturing PDA01-11, issue # 2 or later approved revisions.

1.2 These instructions apply to CAM Pull Start Clutches with Part Numbers 1971890-N, M, R and 1940969-N. This ICA describes the installation and required maintenance elements.

1.3 Distribution of this ICA is accomplished at the time of sale of CAM Pull Start Clutch. This ICA is also available via the CAM website. Should there be a revision, the latest version would be available on the CAM website.

1.4 Revisions of this ICA are done by entire replacement only. All pages are at the same revision status, and are in effect as shown in the Header.

## 2. ELIGIBILITY:

2.1 CAM Pull Start Clutches may be installed in any Continental C75, C85, C90, O-200, C125, C145, O-300 A, B, C or GO 300 A, B, C, F, configured for a Delco-Remy Starter and Drive, as per CAM Replacement Parts List, Document CA-C-01, Rev. B-2 or later approved revision.

## 3. PRE INSTALLATION INSPECTION:

\*\*\* WARNING \*\*\*

**DISCONNECT BATTERY AND MAKE SURE MAGS ARE GROUNDED BEFORE ATTEMPTING THESE PROCEDURES**

3.1 Remove the starter motor assembly from the engine.

3.2 Inspect the pinion pivot shaft in the rear of the crankcase. It must be free of nicks or wear in the area of starter clutch travel. Inspect the crankshaft gear for wear on the gear teeth. If the crankshaft gear teeth or chamfers are damaged or rounded on the leading edge, the gear must be replaced.

3.3 Inspect the bushing in the starter housing. Inspect the starter housing and determine if the housing is machined for an oil seal. If the housing is machined for a seal, ensure that the correct seal is installed (the seal should not protrude above the machined surface of the housing). If the housing is not machined for a seal, a leather packing is required.

**IMPORTANT – IMPROPER SEAL INSTALLATION MAY RESULT IN THE LOSS OF CLEARANCE BETWEEN THE STARTER CLUTCH PINION GEAR AND THE CRANKSHAFT GEAR**

3.4 Inspect the unit you are removing. There may be telltale indications that could save you additional problems. If the drive teeth are worn, the problem is caused by improper meshing of the drive with the crankshaft gear upon start up. If the clutch is slipping, the clutch body located under the crimped on cap is likely cracked. If either of these conditions are present, check the following:

- Front bushing in starter housing worn.
- Tension of release spring inadequate.
- Engine may kick back when starting (this causes the broken housings)
- Improper set up of the mechanical linkage that engages the clutch and connects the starter motor.

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CI-02-01 Revision: E Issue date: April 30 2003 Print date: 30/04/03 Page 3 of 5

- Inspect the crankshaft gear for damage or wear.
- Check MAG timing and impulse operation. Be sure the owner / operator understands that the engine must be started on the impulse magneto only, if there is only one impulse magneto!

#### **4. INSTALLATION:**

4.1 Install this clutch in the same manner as the original Delco–Remy Starter and Drive. Refer to the prevailing TCM publications and the information provided here. There is no difference in installation or operation.

4.2 Lubricate the clutch pilot shaft liberally with clean engine oil, and insert the starter clutch over it.

4.3 Install the starter motor. Turn the starter clutch and push it in by hand so as to butt the pinion gear against the face of the crankshaft gear. Release the starter clutch and make sure that there is at least 1/8" clearance between the starter clutch pinion gear and the crankshaft gear.

4.4 Pull the pivot lever toward the switch and turn the crankshaft until the starter clutch pinion engages with the crankshaft gear. Pull the upper end of the pivot lever rearward as far as possible. Attempt to push the starter clutch further into the accessory case. If the clutch cannot be moved inward, loosen the lock nut and turn the adjusting bolt to obtain 1/16" clearance. (The lock nut may be repositioned to the other side of the lever if required.)

4.5 Check to ensure that the pull cable return spring has sufficient tension to return the pivot lever to its fully released position. It is also necessary that there be a minimum of 1/16" clearance between the starter clutch shaft and the pivot lever when the cable is released (see figure 1).

4.6 Operate the pivot lever control and measure pinion travel. Travel should be a minimum of 1/2" and a maximum of 9/16". The movement can be measured on the visible part of the starter clutch as shown in figure 1. Adjustment is made by loosening the lock nut and turning the adjusting bolt.

4.7 Operate the cable mechanism. It is very important that the pivot lever moves the starter clutch 7/16" BEFORE the adjusting bolt contacts the starter switch. The remaining 1/8" to 3/16" of travel will be used up in making the electrical contact of the starter switch.

4.8 It is important that the clutch actuating lever is correctly adjusted after the clutch is installed (as per original instructions and service bulletins). Failure to do so may result in the starter motor turning the clutch before it is engaged with the crankshaft gear. This would result in failure to start and gear damage inside the engine.

**VERY IMPORTANT – Be absolutely certain that the clutch is set up to become fully engaged into the crankshaft gear BEFORE the electrical connection is made to the starter motor.**

4.9 After all adjustments are complete, recheck to see that all necessary clearances have been maintained. Check that MAG timing is set correctly and that impulse cams are operating properly.

#### **5. CONTINUING AIRWORTHINESS INSTRUCTIONS:**

5.1 The continuing airworthiness of the clutch, and the starting system as a whole, is unchanged from the original instructions included in the Continental Manuals.

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CI-02-01 Revision: E Issue date: April 30 2003 Print date: 30/04/03 Page 4 of 5

5.2 Once properly installed, the 1971890-N, M, R and 1940969-N clutch will function in exactly the same way as the original Delco-Remy product. All maintenance functions required by Continental must be carried out.

5.3 If the clutch slips, it should be returned to Canadian Aero Manufacturing for inspection.

5.4 Starting very cold engines should be avoided. Such attempts put extra stress on the starter and clutch, and increase the chance of kickback. This stresses the clutch even more. **PREHEATING IS RECOMMENDED!**

5.5 Do not attempt to disassemble or repair the clutch, and do not run the engine with the clutch removed.

5.6 ***Important Note*** - This clutch may only be repaired by Canadian Aero Manufacturing. The two piece pinion gear and drive boss assembly used in the 1971890-N, M, R or 1940969-N clutch is custom fabricated from aircraft quality steels and is heat treated in a special sequence to obtain maximum strength, proper function and durability. Repairs undertaken by any company other than Canadian Aero Manufacturing may incorporate an automotive style pinion gear which may result in damage to the engine and unsatisfactory operation.

## **6. ADDITIONAL MAINTENANCE REQUIREMENTS:**

6.1 The Pull Start Clutch ***must be removed from the engine annually*** and be inspected for continuing airworthiness as follows:

6.2 Inspect the end of the pinion gear for damage which can result from clashing due to improper set – up. If damaged, return the clutch to Canadian Aero Manufacturing for repair.

6.3 Rotate the pinion gear clockwise when held facing you. The gear must turn smoothly without any ratcheting or chatter. If damaged, return to Canadian Aero Manufacturing for repair.

6.4 Inspect the face of the pinion gear teeth, which will be polished by contact with the crankshaft gear, to verify that the pinion gear was engaging at least 3/8” or more onto the crankshaft gear when starting the engine. If less, pay special attention to set – up when reinstalling.

6.5 Inspect the large gear for wear or damage. Inspect the fit of the gear to the shaft for any evidence of wear or movement. If unsatisfactory, return the clutch to Canadian Aero Manufacturing for repair.

6.6 Test the retraction spring under the pinion gear for 14 to 18 pounds resistance on 5/8” compression. Test the spring installed into the opposite end of the shaft for 40 to 50 pounds resistance on 5/8” compression. If either spring fails, return the clutch to Canadian Aero Manufacturing for repair.

6.7 Inspect the crankshaft gear for condition. The edge of the gear must exhibit an undamaged bevel and the teeth must not be damaged. Replace if necessary. Inspect the copper bushing for satisfactory condition. If visibly worn or damaged, return the clutch to Canadian Aero Manufacturing for repair.

6.8 Reinstall the clutch in accordance with Continental's instructions. Be absolutely certain that the clutch is set up to become fully engaged into the crankshaft gear ***BEFORE the electrical connection is made to the starter motor.***

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CI-02-01 Revision: E Issue date: April 30 2003 Print date: 30/04/03 Page 5 of 5



**7. TROUBLE SHOOTING:**

PROBLEM	POSSIBLE CAUSE	ACTION REQUIRED
1.Engine kickback when starting	Linkage that engages the clutch and connects the starter motor is not properly set.	a) Check housing for damage. b) Set up linkage properly.
2.Clutch slipping	(i) Front bushing in the starter housing worn out. (ii) Inadequate release spring tension (iii) Clutch body under the crimped on cap could be cracked	Check bushing for wear and repair as considered necessary. Set the spring. Check areas for cracks. Return to CAM for further inspection.
3. No starter noise. Starter not turning	Improper cable set up and pinion travel adjusting nut.	Check cable set up, starter solenoid and starter switch on starter motor body.
4. Grinding noise	Gear not engaging with crank shaft	a) Inspect clutch gear end. b) Crank shaft gear for damaged gear teeth. c) Return to CAM for further inspection.

**Note:** Any questions regarding this clutch should be addressed to Canadian Aero Manufacturing, 2648 Ego Side road, Orillia, Ontario, Canada L3V 6H3; Tel # (705) 326 1368.

Residents of USA may return the clutch for service to Niagara Air Parts, Inc., 9900 Porter Road, Niagara Falls, New York, USA 14304; Tel. # (800) 565 4268.

The preceding constitutes the entire ICA for Canadian Aero Manufacturing Pull Start Clutches.

**E N D**